DOCUMENT RESUME

ED 287 806 SP 029 318

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TITLE Vocational/Technical Education for the 21st Century.
PUB DATE 87
NOTE 21p.; Paper presented at the World Assembly of the International Council on Education for Teaching (34th, Eindhoven, Netherlands, July 20-24, 1987).
PUB TYPE Speeches/Conference Papers (150) -- Information Analyses (070) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Educational Needs; Education Work Relationship; Elementary Secondary Education; *Futures (of Society); Higher Education; Lifelong Learning; *Technical Education; *Technological Advancement; *Vocational Education

ABSTRACT

Teacher education and teachers, particularly vocational and technical education teachers, must keep abreast of the trends and changes in the workforce and employment needs around the world. Education must be geared toward helping individuals to explore their options and to continue learning throughout their life span. This flexibility is needed as the world becomes increasingly technological and concepts learned today become obsolete tomorrow. Four major changes that may affect vocational education and training involve: (1) the invalid expectation of continuous lifetime employment of all workers; (2) the need for a better theoretical understanding in certain fields; (3) a greater emphasis on human and social factors; and (4) informed technical education. Technology education can help pupils fulfill their individual potential, raise overall national levels of educational attainment, bring about greater equality of educational opportunity, and foster social and cultural cohesion. Basic conditions for such education includes common standards for technology as an educational subject, standardization in electronic hardware and software, willingness of industrialized nations to assist developing nations, and cooperation between science- and work-related disciplines for the development of educational programs. (CB)

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THIRTY-FOURTH

WORLD ASSEMBLY

July 20-24, 1987

Eindhoven, The Netherlands

VOCATIONAL / TECHNICAL EDUCATION FOR THE 21th CENTURY

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VOCATIONAL TECHNICAL EDUCATION FOR THE 21st CENTURY

The title of this paper may look a little presumptuous at first sight. Let me therefore explain it to you.

We have come together here in this lecture hall from all parts of the world. As we sit here together we represent many nations and many cultures, but we have at least one common concern: that is to create the opportunity for all our people, not only to survive in the next decade but to better our living conditions as well. To better our conditions not only in a national way, however essential that may be for many, if not for most of our people, but to create a society that will grant equal opportunities for everybody as well.

EMPLOYMENT

In the industrial countries tens of millions of people are unemployed. For third world countries, the situation is even worse. In 1982 the International Labour Organisation (ILO) estimated that a thousand million new jobs would have to be created by the year 2000 in order to achieve full employment.Since then, the situation has worsened.

Any society which continues to propagate the job ethic and to link basic incomes with jobs but which leaves millions of people jobless will inflict damage both on the jobless population and on itself.

Besides the pessimistic view that the present unemployment crisis will lead to continuing decline or disaster, there are three positive views about the future of work. The first is that full employment will return, and that employment will remain the normal way of organising work. The second is that we have begun the transition to a leisure society in which leisure will replace jobs as the central life activity for increasing numbers of people. The third is that full employment will not return and that for increasing numbers of people it will be replaced by self-organised work, or 'ownwork', i.e. activity which is purposeful and important, and which people organize and control for themselves. It may be paid or unpaid. It is done by people as individuals and as household members; or by groups of people working together; or people who live in a particular locality working to meet local needs.

As the preceding analysis made clear, our Technologies and social structures are changing. This will change the shape of our work, which will in turn change the central thrust of our society. Employers will in general continue to try to reduce the number of their employees, for example the 'privatization' of specific functions within an organization, hospitals privatizing their cleaning arrangements; advertisements agents using creative consultants; manufacturers subcontracting out. Employment has turned work into an activity which is dependent, remotely controlled and instrumental. Work in the post-industrial age will have to become more autonomous, more self-controlled and more directly related to the needs and purposes of those who are doing the work. When individuals can choose, they will find that they are effectively selling the fruits of their labour and not the labour itself - a small change in emphasis, a great change in relationships. Many more will see work as a means to living, not as an end in itself.

Predictions of the implications of Technological development for levels of skill requirements throughout economies generally are hazardous - largely because they are not exogenous and inevitable. That widespread change in the skills used and required in the economy will occur is widely recognised. But, as with prognoses of the future levels of employment under the impact of Technological change, views differ widely about the nature of employment in the years to come. Some argue that as Technology becomes sophisticated it will require more highly skilled people to operate equipment and put it to its most productive use. Others envisage that a minority of the workforce, particularly managerial and technical staffs, will be confronted with complex tasks but that the majority will be in unchallenging work as sophisticated machines take over work functions at present in human hands.

The path we take in the future depends crucially upon the ability of society and its institutions to change and of our education systems, in particular, to promote that change. Even the official US Department of Labor manpower projections foresee a relatively small growth of jobs for computer systems analysts, data-processing machine mechanics and computer programmers compared with several semi- and unskilled occupations in the service sector. Thus, the urgency of a concerted educational response is underlined.

Personnel with middle-level skills e.g. paraprofessionals, technologists and technicians have special training needs. Broadly, they may be characterized as people with training below that normally obtained in universities and above that obtained through traditional skill training. The work they do combines technical and managerial responsability. They have to keep up with changes in scientific and technical knowledge. Their education and training call for concerted policies by educational institutions,

particularly non-university tertiary colleges,and new kinds of curricula that integrate theoretical and practical learning, introduce new pedagogical approaches and forge closer links with local economic activities. In a similar vein education is being reconceptualised and the first steps are being taken to bridge the chasm between education and society.

EDUCATION

During the 1970's it became generally accepted throughout the world educational community that many conventional arrangements and practices were indeed obsolete and inefficient and required substantial change. Until then, a person's education was measured by years of classroom exposure and by the type and level of educational credentials earned. This institution and age-bound concept of education implied three things that did not square with everyday experience:

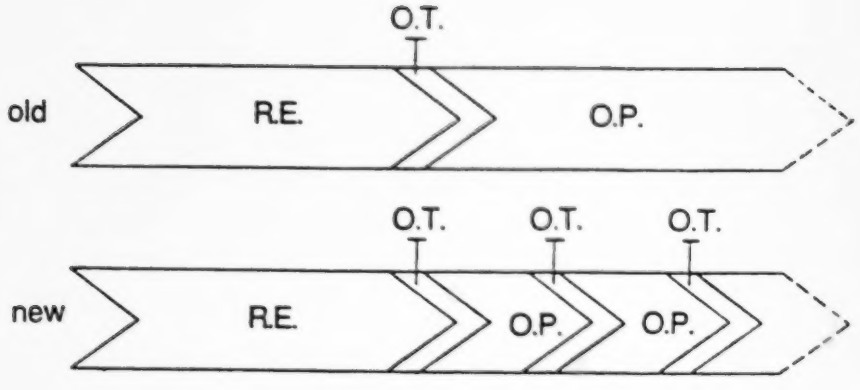
1. that schools, and only schools, could meet all of the essential learning needs of individuals;
2. that this could be accomplished, once and for all, during an individual's school-age years;
3. that anyone who lacked proper schooling was ipso facto uneducated.

A broader view emerged which recognized that education occured whenever, wherever and however learning took place.

This enlarged concept of education in no way lessened the importance of formal education systems; it simply reflected a belated recognition that formal schools and higher institutions, though well-suited to meeting certain types of important learning needs, could not be expected to meet the full spectrum of lifetime learning needs of all age groups in the population. People will increasingly exercise their own individual interests and priorities in adapting to their social situation; work study and leisure activities.

The nature of education is being further altered by the pressures arising from Technological developments. In the past, following a Technological revolution, a stable period allowed educators to develop their methods of preparing employees for industry. In many cases, following a period of education, a person could be trained to practise a profession for a lifetime. Any changes within trades were sufficiently slow to enable people to pick up the required knowledge whilst on the job. Skills were appropriate educational goals. Today the fast changes do not permit such a luxury. Educationalists now face a dynamic, rather than static problem. Contemporary Technological developments not only bring about abrupt changes within the trades but they also break the traditional border lines between them. This situation forces us to reconsider the old and accepted appraoch of skill-based preparation of manpower for industry.

What should be considered is a different approach in which we recognize that specific knowledge will need to be gained continuously. An essential part of the educational system is, therefore, the preparation of its graduates not only for their role as professionals within industry but also as permanent learners. Courses must not only transmit the requisite knowledge, but they must also incorporate the educational building blocks that enable us to continuously learn and upgrade our knowledge and abilities. The tendency towards more individual control and choice must be encouraged. This flexibility is given increased importance by the coming shift in employment opportunities from the manufacturing to the service sectors.



R.E. = Regular Education
O.T. = Occupational Training
O.P. = Occupational Practice

Traditionally, educationalists have disregarded forecasting as a curriculum planning tool. Whilst largely due to the inertia of a traditionally conservative profession, they can claim to have protected schools from the havoc that would be caused by trying to follow every prevailing educational fad. The danger of this approach, particularly in times of rapid and significant change, is that formal education becomes irrelevant to society and the resulting disparity can seriously weaken the social fabric of a country. Generally, the ability to respond to change will be the criterion by which all sections of society will be judged.

Educational systems have grown and changed more rapidly than ever before. But they have adapted all too slowly in relation to the faster pace of events on the move all around them. The consequent disparity - taking many forms - between educational systems and their environments is the essence of the worldwide crisis in education.

Among the disparities are:

- the growing obsolescence of the old curriculum content in relation to the advancing state of knowledge and the realistic learning needs of students;
- the misfit between education and the development needs of societies;
- the growing imbalances and maladjustments between education and employment, as well as serious educational inequalities between various social groups;
- the growing gap between the rising costs of education and the funds countries would be able and willing to invest in it.

Causes for these disparities are:

1. the sharp increase in popular aspirations for education;
2. the acute scarcity of resources;
3. the inherent inertia of educational systems which caused them to respond too sluggishly in adapting their internal affairs to new external necessities, even when resources have not been the main obstacle to adaptation;
4. the inertia of societies themselves - the heavy weight of traditional attitudes, prestige and incentive patterns, and institutional structures which has blocked them from making the optimum use of education and of educated manpower to foster national development.

THE CONTENT OF VOCATIONAL EDUCATION

There are four major changes in the nature and structure of employment that seem likely to affect the concept of vocational education/training.

1. Continuous lifetime employment can no longer be expected by all workers. If people cannot get continuous work, where does this leave the concept of vocational education? One response is to maintain the existing pattern of vocational education/training.

2. The need for a better theoretical understanding in certain fields than was the case in the past. Of course, examples of the opposite trend come quickly to mind: using calculators instead of mental arithmetic, and replacing components instead of repairing them. However, the general trend in many fields is for courses to become more 'scientific': this is true in fields as different as electricity, electronics, accounting and nursing. Some practitioners see this scientific or academic 'drift' as a result of too much school/college-based training, and not enough learning on the job. The reasons for it, however, may also have to do with the increasing sophistication of Technology and organization.

3. Another trend that affects training is, in some ways, the opposite: a greater emphasis on human and social factors. The importance of human factors - motivation, communication, job satisfaction, group norms - in production is a basic element in modern management theorie, and may be related to the democratization of work structures. Equally, the social effect of Technology, its impact on the community and the natural environment, is also a topic which is now included in some training courses at every level, from general vocational preparation to the medical, legal and other professions.

4. Technical education to the extent that it also addresses employment objectives has to be informed in which areas of the economy employment may be maintained or increased. Vocational training has to bear in mind that most of the present employment creation happens in small and medium-sized enterprises. This is particularly significant as it constitutes the reverse of an earlier tendency towards more employment in large enterprises. Vocational training policy has to draw conclusions from this reversal and provide training which appears particularly relevant to small and medium-sized companies.

CONVERGENCE AND THE DEVELOPMENT OF A TECHNICAL CULTURE

In the near future, the four trends outlined here - youth unemployment, increasing sophistication of some work processes, a greater emphasis on human factors and the growth of small business - seem likely to influence the pattern of vocational education and in some respects make the distinction less sharp between it and general education. In the longer term, the role of technical education at the post-compulsory stage could assume more prominence in two ways. Technical education is a form of vocational education in that it prepares students for middle and higher-level posts in occupations that have some scientific or at least systematic basis. It can also be fairly general in its scope, since such occupations involve not only theory but application, not only fact but values and choices. Technical education can be seen, therefore, as a potential 'bridge' between the general and the vocational. This bridge could take on more numerical importance if a larger proportion of the age group eventually enrolled in technical streams, even to the point where general and vocational streams became the minority ones. A second possibility is that technical education will itself develop a language of generality that will allow it to claim to be the appropriate general education in a Technological society.
It is a language that, significantly, appears to cut across both subject and occupational boundaries.

THE CHALLENGE OF NEW INFORMATION TECHNOLOGIES

Whatever the disagreements about the precise implications of new information Technologies, it is generally agreed that they are having far-reaching effects upon the kind of society we live in. The implications for education and training of the new information Technologies extend well beyond the preparation of workers with the new skills needed to use this Technology. It implies the much broader education of society to be able to use Technology to the ends it chooses, and to innovate and create in order to harness its potential.

Perhaps, even more fundamental, as far as education is concerned, the fact that these Technologies may well be changing our models of thinking, intelligence, memory and attention and hence knowledge, learning and teaching. Thus the long-term impact upon education may extend well beyond the possibilities opened up for new ways of learning reading, writing or a foreign language.

For some, these developments represent an evolution rather than a revolution - another development, like others before, that only add to the pedagogical equipment available to schools and teachers. This is, however, probably a serious underestimation of their potential as the situation is essentially new in a number of respects. First, the educational potential of the new information Technologies is larger than had been anticipated two decades ago on the basis of the computer-based teaching/learning methodologies developed at the time. More importantly, IT is a phenomenon of society, not one confined to education. IT is part of the larger world around us, it is the medium through which the whole of society is being revolutionized.

The issues raised are wide-ranging. There are relatively specific questions such as how schools should invest in equipment, the availability of different kinds of software and how education should appraoch the teaching of specific subjects such as information science and computing. There are the broader questions of how new Information Technologies can be used throughout education for new methods of learning - what are their potential and use?

APPLICATION OF TECHNOLOGY IN EDUCATION

Starting in the seventies Western Europe governments have introduced Technology as a new subject in secondary education. This introduction took different forms in each country and the results vary from country to country. The results as a whole appear to be not satisfactory, due to many reasons. Let us see what happened in the Netherlands.

Starting in 1973 the Dutch Government decided to introduce a new subject in pre-vocational education. This subject was to be taught in the first two years, thus for children in the age group 13-15 years. The idea behind the introduction of this subject had not really been thought-out well. This new subject, called 'general Technology', aimed at 'hands-on' skills, by means of which originality and self expression of the children would be developped and stimulated.

A well conceptualized curriculum was missing, to start with. The teachers who were to teach this subject, came from a wide variety of backgrounds, ranging from such disciplines as carpentry, metal working and electrician to fashion, needlework and teaching of textural arts. There was no structural plan for extra training for those teachers and the initiative petered out into a pluriformity of activities, some of them aiming at basic skills, others consisting of mere occupational therapy.

There is a lesson to be learned from this experience that can be translated as follows: Learning about modern Technologies, should not be narrowly conceived to mean acquiring only the skills for their use, nor is it free of risks. Priority should be given to enlarging the understanding of their place in modern societies. Therefore, the overall aim should be educational for the mastery of the enormous potential new Technologies offer, which means the command of how they are to be used as much as how they can be operated.

During the period 1990-1994 a second attempt will be made to introduce 'Technology' as a compulsory subject in the first two years of secondary education, i.e. the age groups of 13-15 years.

In the doctrine as we envisage it, Technology is justified as a teaching subject because people are confronted with Technology as a real phenomenon in our society.

Secondly it forms a bridge connection for the pupil to real life. This bridge rests on a number of piers. These piers are six in number. Firstly: energy, material and information. Secondly: to make, to manage and to apply.

This dichotomy looks artificial but that is not the case. Pupils need knowledge, both in a cognitive and in a practical sense, to cope with the first three piers. But with only these three piers the bridge would collapse. Extra foundation is needed by the other three piers. They will procure affinity, experience and consequently self-confidence.

In this way the six piers will give the strength to all pupils to cross the bridge in their own individual way. For some pupils, the so-called 'more gifted ones', the first three piers give all the needed support. The more practically disposed ones will mostly need the support of the last three piers.

This vision is not a typically Dutch one. There is general agreement on what the aims ought to be:

* to help each pupil fulfill his or her potential;
* to raise overall national levels of educational attainment;
* to bring about greater equality of educational opportunity, if not outcomes;
* to foster social and cultural cohesion.

In short, Technology is a "must" for all pupils, all over the world!

If and when these aims are fulfilled, a starting position has been created for the pupils to go on with their further education.

World-wide a growing tradition exists in technical education to divide Technology in separate disciplines, such as electrical engineering, mechanical engineering, civil engineering, industrial engineering, architectural engineering, etc. The problem is that there is a tendency to split Technology in these seperate disciplines at a too early stage. Teachers will try to introduce Information Technology in their discipline at a too early stage as a means to upgrade the quality of their specific discipline. In this way curricula tend to become top-heavy with desastrous results for the students. This is what happens in technical education. (see figure 1)

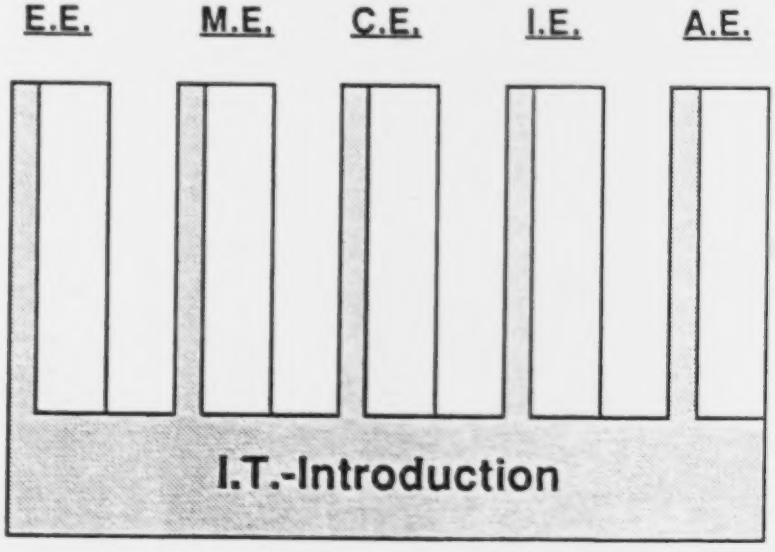


Figure 1

After a short introduction of IT in the basic year of the curriculum IT is interwoven with the technical application in each discipline. By doing so the discipline is more and more narrowed down because the curriculum lacks the possibility to expand its hours. The result even is that some teachers try to add an additional year to their courses in order to give an extra input to IT developments as such. (see figure 2)

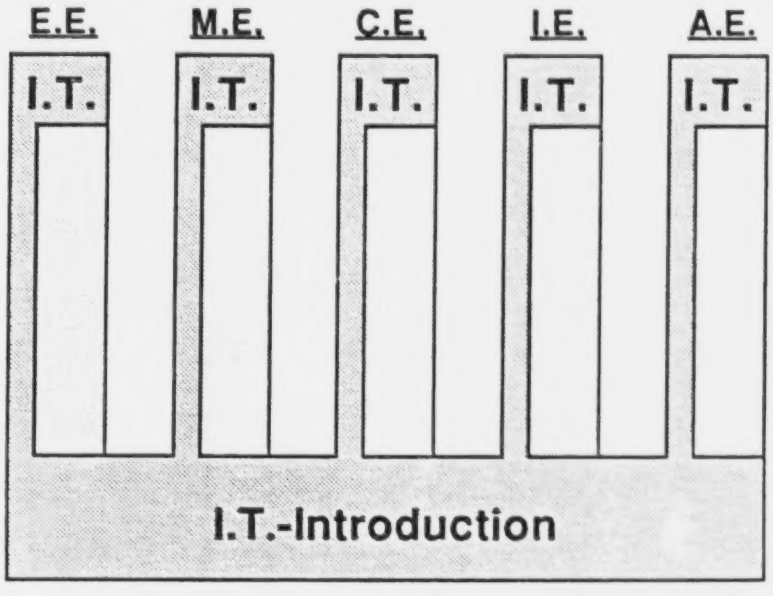


Figure 2

Apart from the fact that it is a budgetary impossibility to finance such developments in regular education, people should realize that IT needs a broader base as an educational subject.

It cannot be stated enough that IT cuts across the limited boundaries of separate technical disciplines. It is a means in itself to reshape our technical education in such a way that it prepares our future workers for careers with a broader view. This goes for regular education as well as for day-release education.

Figure 3 shows how the implementation of IT fits in a modern curriculum. Obviously this does not apply for higher technical education, where the student has chosen for a direction and discipline on such an advanced level, that specialization goes without saying.

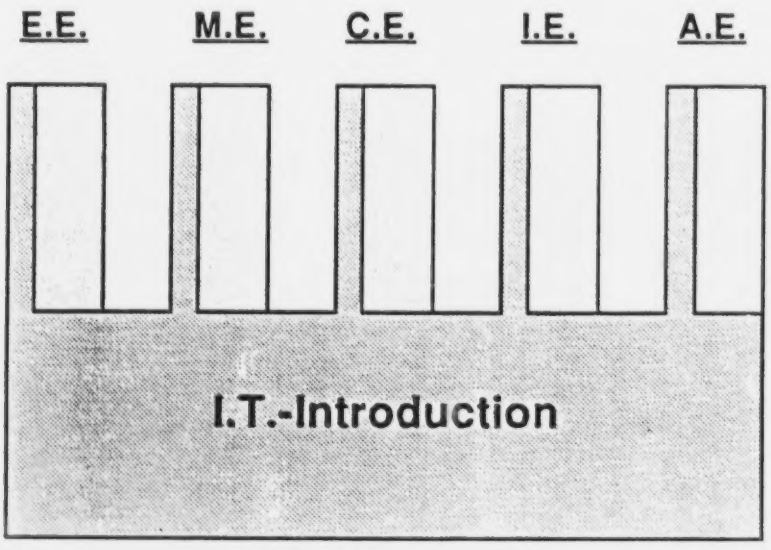


Figure 3

In conclusion, education has to prepare people for a rapid and complex world of change and is itself a powerful vehicle that facilitates and guides this change. A central role for education and training derives from the fact that modern economies depend upon advanced knowledge and skills which are in a stage of rapid evolution, hence generating the constant need for learning throughout the economically active population and a new balance between physical and human capital. Predictions of the precise impact of Technological development upon job skills and employment levels differ widely but that these skills will undergo widespread change is generally recognised. The speed of Technological change

and the consequent obsolescence of knowledge, and the fact that most people will change their jobs more than once during their working lives (and several times in many cases) clearly call for extensive recurrent education opportunities for professional training and retraining. The effects of rapid technical developments are felt in the organisation of work as well as in the skills required for different jobs. As the distinctions between scientists, engineers, technologists, technicians and craftsmen become more blurred, so does a new organisation of education and training need to be conceived.

This does not diminish the importance of basic education; it implies that each should achieve the soundest possible start which can be built upon throughout the rest of their lives. The fact and speed of change, however, place a premium upon the acquisition of more generic abilities, which can be classified broadly as 'learning to learn', as well as the appetite and motivation for further learning. Technological developments increasingly appear to call for polyvalent skills and the ability to work in close co-operation with others that is not reflected in the 'ethos' of much present educational provision, with its emphasis upon individual achievement and narrow specialisation. The tasks confronting the formal school system for children and young people are thus no less demanding than those of the education and training systems for adults.

SUMMARY:

If we agree on the necessity of teaching Technology as a subject of its own at an early stage in education, we also need to realize that Technology as a start needs a follow-up. And as we talk about Technology in the 21st century, let us have a look at the practical possibilities of Technology as an educational means. Technology can expand world-wide from country to country.

I just mention some examples:

- the use of common data banks;
- common software for computer aided educational programs;
- distant education (tele-education), especially in technical education;
- simulation programs when studying processes;
- educational programs replacing the teacher, thus enlarging individual schooling possibilities;

Basic conditions for the above mentioned educational fireworks are:

(i) common standards for Technology as an educational subject;

(ii) standardization in electronic hardware and software, i.e. world-wide compatibility of systems;

(iii) a growing willingness of the industrialized nations to assist the Third World in developping their Technological infra-structure, not only by means of exporting their knowledge but by exporting feasible technical means as well;

(iv) a growing willingness of the world of science and the world of work to cooperate closely in the developping of educational programs.

In this paper we intently refrained from treating on detailed subjects. However, we would like to call your attention on an example of our national activities in the field of educational developments. After this lecture there will be copies available of the description of NIVO, a pilot project for New Computer Appraoch in Secondary Education in the Netherlands. With this introduction we rather intend to give the initial impetus to the discussion in working groups. I wish you the best of luck with your efforts.

ACKNOWLEDGEMENTS:

A.F.D.E.T., "L'enseignement technique nr. 130", Association Française pour le développement de l'enseignement technique, Paris, april 1986.

C.E.D.E.F.O.P., "Professional situation and training of trainers in the member states of the European Communities - Synthesis report", Office for Official Publications of the European Communities, Luxembourg, 1983.

C.E.D.E.F.O.P., "Technological change, employment, qualifications and training", Office for Official Publications of the European Communities, Luxembourg, 1985.

C.N.D.P., "Informatique pour tous", Centre National de documentation pédagogique, Paris, 1985.

J.W.M.A. Houben & J.A. Verbunt, "Computer Education in the Vocational Teacher Training Centre at Eindhoven", NLO-Eindhoven, 1985.

S.L.O., "Leerplanvoorstel Techniek, deel 1", Stichting voor de Leerplanontwikkeling, Enschede, 1986.

D. Sharon, J. Harstein & G. Yantian, "Robotics and Automated Manufacturing", Pitman Publishing, London, 1987.

* The writers wish to express their special appreciation to Dr. Daniel Sharon for his contributions to the development of robotics as a teaching subject in vocational and general education.